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Mr. Chairman, members of the Subcommittee, I appreciate the opportunity to join you today at Grand Canyon National Park to discuss the potential use of hydrogen fuel cell technology in the National Park System. The Grand Canyon is one of the "crown jewels" of the National Park System and a most appropriate venue for our discussion here today.

I know the subcommittee is focused on ways to preserve the unique sites, sounds, experiences and pristine environments in the National Parks even as they host more than 280 million visitors and their attendant vehicles each year. The challenge for the National Park Service (NPS) is to continue to showcase these natural treasures while protecting them for future generations. Applications of clean energy technologies at our National Parks can help meet that challenge.

Clean Energy Projects at National Parks

National Parks provide good opportunities for renewable and other alternative energy technologies because many sites are remote and far from existing electric or gas grids, making the projects more cost effective when compared to conventional systems. National Parks are particularly well-suited to fleet vehicle demonstrations because they offer a controlled environment with self-contained fueling infrastructure and central maintenance facilities. And because the parks place a high value on pristine environments, there is a greater value placed on non-economic environmental and other benefits of clean energy.

The Department of Energy and other federal agencies recognize the value clean energy projects can play in the National Parks. The Green Energy Parks program, a joint program of the Department of Energy (DOE) and Department of Interior (DOI), supports projects that demonstrate a range of energy efficiency, alternative transportation fuels, and renewable energy technologies in parks throughout the Nation. Technologies have included alternative fuel vehicles, fuel cells for mobile and stationary applications, and solar photovoltaic and thermal energy systems. Some examples include:

- A 4.5-kilowatt proton exchange membrane (PEM) fuel cell system at the West Entrance to Yellowstone National Park that powered an office building and ticket kiosk through which one million visitors pass each year. The system was

installed in May 2002 for a one-year trial with propane as the feedstock from which hydrogen was reformed. The project was taken out of service.

- Two 5-kilowatt PEM fuel cell systems manufactured by Plug Power have been purchased for use at Yosemite National Park. Each is fueled by propane and is capable of providing 5 kilowatts of electricity, as well as additional heat and hot water. The first has been installed at the Administration Building in Yosemite Village. Site selection is in progress for the second unit.

- A 115-kilowatt solar photovoltaic array, a 2.4-megawatt-hour battery bank, and a backup propane generator provide power to the marina on Lake Powell at Glen Canyon National Recreation Area in Utah – the largest clean energy project to date at a National Park. This project eliminated the need for diesel to be shipped by barge across Lake Powell.

Several projects demonstrate how energy efficiency practices and renewable technologies can work together. For example, at Dry Tortugas National Park -- located on a remote island in Florida -- conservation measures were able to reduce energy use from 100 kWh per day to 50 kWh per day. A hybrid 14kW photovoltaic system was then able to fully replace the existing costly diesel generators. Efficiency improvements at the Dry Tortugas included use of high-efficiency, Energy Star air-conditioning systems; use of the highest efficiency, Energy Star appliances available on the market; replacement of electric water heaters with solar units; replacement of electric ranges with propane units; and education of facility users on efficient practices in operating systems and equipment. A similar approach was used at Assateague Island National Seashore in Virginia.

In addition to the projects mentioned, there are biodiesel-fueled boats at Channel Islands National Park, compressed natural gas powered shuttle buses at Grand Canyon National Park, propane shuttle buses at Zion National Park, and snowmobiles that run on ethanol at Yellowstone National Park. DOE has also supported the Park Service in installing solar photovoltaic arrays at the Zion National Park, Channel Island National Park, and Redwood National Park.

Path Forward to a Hydrogen Economy

Before turning specifically to the topic of a hydrogen fuel cell demonstration in a national park, I'd like to briefly discuss where we are on the President's Hydrogen Fuel Initiative. Using hydrogen to fuel our economy can reduce U.S. dependence on imported petroleum, diversify energy sources, and dramatically reduce pollution and greenhouse gas emissions. In short, hydrogen fuel cells have the potential to revolutionize the way we power our Nation and drive our cars.

In the long-term vision of the hydrogen economy (which will take several decades to achieve), hydrogen will be available in all regions of the country and will serve all sectors of the economy. It will be used throughout the transportation, electric power, and consumer sectors. It will be produced using technologies that emit no pollutants or

carbon dioxide – fossil fuels (with carbon capture and sequestration), renewable energy, and nuclear power. Solar and wind as primary energy systems can, in addition to generating electricity, be used to produce hydrogen from water using electrolysis. This hydrogen, in turn, can be used to power fuel cells. In this manner, hydrogen can be used as the energy "storage medium" allowing us to more fully employ intermittent renewable resources such as solar photovoltaic and wind. Moreover, when hydrogen is produced and used in this manner, pollution and greenhouse gas emissions are zero.

That is why the President proposed that we significantly increase our spending on hydrogen infrastructure R&D, including hydrogen production, storage, and delivery technologies, as well as fuel cells. Over the next five years, we plan to spend an estimated $1.2 billion on the Hydrogen Fuel Initiative, doing what needs to be done to make the President's vision a reality.

Achieving a hydrogen economy will require a combination of technological breakthroughs, market acceptance, and large investments in a national hydrogen energy infrastructure. Success will not happen overnight, or even over years, but over decades. It will require an evolutionary process that phases hydrogen in as the technologies and their markets are ready. Success will also require that the technologies to utilize hydrogen fuel and the availability of hydrogen occur almost simultaneously.

Among the significant hurdles we face are:

- The need to lower by a factor of four the cost of producing and delivering hydrogen;
- The need to develop more compact, lightweight, lowercost, safe and efficient hydrogen storage systems that will enable more than a 300 mile vehicle range;
- The need to reduce fuel cell costs and improve performance. Today's fuel cells are currently ten times more expensive than internal combustion engines and do not maintain performance over the required life of a vehicle or stationary power system.
- The need for designs and materials that maximize the safety of hydrogen use;
- The need to develop a hydrogen-based refueling infrastructure comparable to the petroleum-based one we have today. This will include development of codes and standards as well as the education of consumers about the use of hydrogen.

Our program is structured so that the technological advancements and lessons learned from successful demonstrations of hydrogen and fuel cell technologies are integrated and work together as a fully functional system. Understanding the complex interactions between components, systems costs, environmental impacts, societal impacts and system tradeoffs is key.

Benefits of a Hydrogen Fuel Cell National Park Demonstration

Clean energy projects at National Parks benefit the Nation in two ways: they bring immediate energy and environmental benefits where they are placed, and they also help educate the public about the ability of clean energy technologies, alternative-fueled

vehicles, building design, and other energy-efficient practices to mitigate the impacts of pollution and congestion on our natural resources. With 280 million American and foreign visitors passing through our National Parks each year, this is a tremendous opportunity. And no one is better equipped for this task than the trained and dedicated staff of the National Park Service. It is much more likely that school children would remember a ride on a hydrogen powered fuel cell bus with a Park Ranger than a Washington bureaucrat giving a lecture in their school.

When it comes to hydrogen, public education is especially important because achieving a hydrogen economy requires a revolutionary change in the way we produce, store, and use energy. The public's natural resistance to change – compounded by concerns about hydrogen safety – poses a significant challenge to achieving that vision.

Although public interest in hydrogen fuel cell technology is growing, there is still a general lack of awareness or acceptance of hydrogen as an energy alternative. The use of this technology in national parks can expose a large cross-section of the public to hydrogen fuel cells, enhance understanding, and raise comfort with using a new technology. Hydrogen fuel cell demonstrations would allow visitors to witness first-hand the safe use of hydrogen and can help eliminate safety concerns.

Finding the Right Balance

The key to the success of any demonstration project is to strike the right balance between R&D, and demonstration and deployment.

Fuel cells are relatively new technologies, and not all the fuel cell projects in National Parks have been fully successful. On the whole, while fuel cells are very efficient and clean, they are typically more expensive and less durable than conventional technologies. That is why DOE's research and development and demonstration program is focused on lowering the costs, enhancing the durability, and addressing other factors which inhibit the broad adoption of fuel cells. Considerable government and industry cooperative research will yet be needed to overcome these barriers.

There are potential benefits to be realized from demonstrating a clean energy technology in one of our National Parks, and we have supported fuel cell projects in the past. However, we need to keep in mind that our goal is ultimately the deployment of millions of clean, affordable fuel cells in stationary and mobile applications throughout the economy, not individual demonstrations. We don't want to divert limited taxpayer dollars needed to resolve technical issues through research and development for unnecessary or lower-priority demonstration and deployment activities.

We also need to make sure that our enthusiasm for hydrogen fuel cell technology does not lead to the premature deployment of technology that is not ready for consumer acceptance. Regardless of our good intentions, bad consumer experiences with the technology can set us back. Because of unsuccessful demonstration projects in the 1970s and early 1980s, many Park Service personnel became wary of solar hot water systems.

With assistance from Sandia National Laboratory, we have since worked to ensure that subsequent projects were successful and have been able to overcome that perception.

Demonstrations to validate technology should yield useful feedback to the research and development process. They need to be monitored closely, with data collected effectively and the "lessons learned" fed back into the overall development process. Unless prototypes have met appropriate technical targets prior to demonstration, we only risk overselling the technology and jeopardizing its commercial success. In addition, it is important for initial demonstrations to be closely controlled and performed in conjunction with the automotive manufacturing and energy supplier industries so that we all may learn from the experience, and can then move on to wider deployment of the technology.

Thank you for the opportunity to discuss these issues here today. I am happy to answer any questions.